

## **PAPER PICKING SYSTEM AND METHOD**

### **FIELD OF THE INVENTION**

The invention pertains to the field of printing and in particular to the field of  
5 automated loading of printing plates.

### **BACKGROUND OF THE INVENTION**

A CTP system accepts input jobs/pages written in a page description  
language, for example, Postscript. The jobs are sent through a raster image  
10 processor to a platemaker for exposure. The platemaker engine images the  
raster data on a plate, which is later mounted on the press, inked and made  
ready for printing:

The inclusion of a CTP system into a printing operation suggests a  
greater extent of automation that can be achieved. A full CTP process can  
15 automate, through the use of computers and special equipment, the transfer  
of information from the original layout to the press plate.

Also included in the automation of a CTP system is the media handling.  
It is necessary to supply plates individually from a plate supply area to the  
platemaker engine and it is desirable to reduce the amount of operator  
20 handling involved.

Automating the printing industry presents unique technological hurdles.  
In the case of printing plates, some of these hurdles result from the delicacy of  
the unexposed emulsion-coated surfaces of these plates. These emulsion-  
coated surfaces are easily marred, and if marred, create undesirable defects  
25 in the final printed product. Attempts to automate the handling of printing

plates require measures to prevent damage to the emulsion-coated surfaces of the unexposed plates.

Measures used to reduce marring of plates during storage or transport, however, introduce additional problems for automation. Unexposed plates are typically supplied in packages of 25 to 100 with interleaf sheets, more commonly referred to as "slip-sheets", between the plates. These slip-sheets, which may be made of a variety of materials, are used to protect the sensitive printing surfaces of the plates by providing a physical barrier between the emulsion on one plate and the adjacent plate. The slip-sheets must be removed from the printing plates prior to imaging.

The automation of slip-sheet removal for the printing industry presents a number of unique problems; slip-sheet removal is not simply a matter of moving a single sheet from a stack of similar sheets. In general, slip sheets are made of materials different from those used for printing plates, and are further differentiated by being substantially thinner, lighter, and less rigid than the plates they separate. These characteristics also make slip-sheets more deformable than their neighboring printing plates. Removing a thin, lightweight, and relatively deformable slip sheet sandwiched between relatively heavy printing plates is a technological challenge further complicated by the fact that the slip sheets must be removed without damaging the sensitive surfaces of the printing plates. The removal process can also be complicated by the fact that slip-sheets and plates are often quite large. At present, very large format printing plates can be as large as 58 inches by 80 inches, with correspondingly large sizes for the intervening slip-sheets. In addition, the actual materials used for slip-sheets can vary,

although commonly the slip-sheet material is paper, which may be fragile and easily torn.

Another difficulty is that slip sheets tend to adhere to printing plate surfaces when plates are separated from each other. As a result, the exact position of the slip-sheet relative to a plate is not consistent. A slip-sheet may adhere to the top emulsion-coated surface of a printing plate as it is moved away from its neighboring plate; it may also adhere to the bottom (i.e. non-emulsion-coated) surface of a plate. The tendency of the slip-sheets to adhere also complicates slip-sheet removal, especially since the slip-sheets must be separated from printing plates without scratching or otherwise damaging the emulsion-coated surfaces of the plates. Since the emulsions are very delicate, any mechanical impact imposed upon the emulsion-coated surface of the plate is a potential source of damage, even if it occurs through a slip-sheet.

A possible means of addressing this problem is to use suction cups to remove the slip-sheets. The use of vacuum is particularly attractive as it has the potential to eliminate unwanted contact with the sensitive surfaces of the printing plates. Vacuum can be used to draw slip-sheets into a desired position from one side, without requiring mechanical contact to move the slip-sheet. Suction cups have been successfully used in other contexts, for example, to move paper in sheet-fed presses.

However, attempts to remove slip-sheets using suction cups tend to fail for a number of reasons:

1. Slip-sheets are often so porous that a suction cup cannot achieve sufficient vacuum suction to lift the slip sheet;
2. The slip-sheet porosity can lead to a suction cup gripping the non-porous

printing plate below, through the slip-sheet, and lifting both together;

3. Slip-sheets can be very large in some application, such that a slip-sheet may be lifted by a suction cup, but the suction cup may not be capable of moving the slip-sheet laterally without releasing it;

- 5 4. Flexible suction cups have very little peripheral stiffness on their own and rely on the stiffness of the object being picked up to maintain a good seal around the edge of the cup, and to prevent the cup from collapsing on itself. Slip-sheets rarely provide sufficient stiffness to permit reliable gripping and are prone to wrinkling at the interface between suction cup and slip-sheet, causing
- 10 vacuum failure and premature release.

Another means for removing slip-sheets is described in US Patent No. 6,164,637 to Harari. The patent provides a foil remover for removing one or more sheets of foil from an underlying hard surface. The foil remover includes a movable carrier and at least one gripper attached to the carrier. The gripper

15 includes many pinching fingers, each of the fingers oriented approximately perpendicular to the hard surface and ending with a tip. The foil remover operates with respect to each of the grippers to bring the tips, mutually apart, in contact with the top sheet of foil and causes the tips to approach each other, and to pinch the sheets.

20 US Patent No. 6,550,388 to McIlwraith provides another apparatus for removing slip sheets from printing plates, having two concentric cylinders that are mutually rotatable about a common axis. Suction exerted via two elongated slots separates a deformable sheet from a relatively rigid object to which it is adhered. The deformable sheet is drawn into a recess presented by

the two aligned slots. The concentric cylinders are then rotated to grip the deformable sheet between opposing edges of the slots.

The above examples indicate that the prior art of automated slip-sheet removal is based on several approaches, however these approaches do not fully address the above-mentioned problems associated with slip-sheet removal in the context of fully automated CTP processes.

Therefore, it would be desirable to provide a system and method for automatic slip-sheet removal in fully automated CTP processes.

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## SUMMARY OF THE INVENTION

In one aspect of the present invention there is provided a slip-sheet picking and discarding mechanism comprising: a roller having a longitudinal dimension spanning the width of said slip-sheet; rotating means connected with said roller; at least one clamping means arranged along the longitudinal dimension of said roller, each said at least one clamping means having a clamping portion and a surface-contact portion; and elevating means for elevating said roller and said at least one clamping means, wherein said clamping portion is positioned at a given distance from said roller when said roller and said surface-contact portion are in contact with the surface of said slip-sheet, and wherein said clamping portion is in contact with said roller when said roller and said surface-contact portion are not in contact with the surface of said slip-sheet.

The apparatus may additionally comprise disposal means for disposing said slip-sheet.

In another aspect of the present invention there is provided a method of picking a topmost slip-sheet from a stack of plates in a CTP imager, comprising the steps of: providing an apparatus comprising: a roller having a longitudinal dimension spanning the width of said slip-sheet; rotating means connected with said roller; at least one clamping means arranged along the longitudinal dimension of said roller, each said at least one clamping means having a surface-contact portion and a clamping-portion; and elevating means for elevating said roller and said at least one clamping means, wherein said clamping portion is positioned at

a given distance from said roller when said roller and said surface-contact portion are in contact with the surface of said topmost slip-sheet, and wherein said clamping portion is in contact with said roller when said roller and said surface-contact portions are not in contact with the surface of said topmost slip-sheet; positioning said apparatus in a first position, wherein said roller and said surface-contact portion are in contact with said topmost slip-sheet; rolling said roller, thereby creating a fold in said topmost slip-sheet and stopping said rolling operation according to predefined criteria; and lifting said apparatus, thereby clamping said fold between said surface-contact portion and said roller.

The method may additionally comprise, after said step of lifting, the step of: rolling said roller a second time, thereby releasing said slip-sheet.

Other features and advantages of the invention will become apparent from the following drawings and description.

## BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention with regard to the embodiments thereof, reference is made to the accompanying drawings, in which like numerals designate corresponding elements section throughout, and in which:

Fig. 1 is a lateral view of the paper picking mechanism according to the present invention;

Fig. 2 is a blown-up scheme of the area denoted by 5 in Fig. 1; and

Fig. 3 is a blown-up scheme of the area denoted by 5A in Fig. 1.

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## DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Fig. 1 is a lateral view of the paper picking mechanism of the present invention. The mechanism, residing in a CTP machine, comprises a picking unit, generally denoted by numeral 6, an elevating mechanism 25 and an inclined surface 70, the lower end of which protrudes from the CTP machine. The picking unit 6 is shown twice in Fig. 1, once in its plates position 5, near a stack 15 of plates separated by slip-sheets, and once in its tray position 5A, for dispensing the picked slip-sheet.

Fig. 2 is a blown-up scheme of the area denoted 5 in Fig. 1, showing the picking unit 6 in the picking position. The picking unit comprises a roller 20 made of high-friction material, preferably rubber. The roller 20 is preferably connected by a timing-belt 50 or by a chain or gear wheel to motor 60. Roller 20 spans the width of the slip-sheet 10 lying on top of the stack of plates. A plurality of clamps 30 are mounted along the roller 20. The clamps 30 are preferably loaded by springs 40. Alternatively, clamps 30 may be designed to use gravitation, by creating unbalance in the clamps. In another embodiment, the plurality of clamps 30 may be replaced by a single clamp spanning the width of the top slip-sheet, in parallel to roller 20.

Fig. 3 is a blown-up scheme of the area denoted 5A in Fig. 1, showing the picking unit 6 in the unloading position.

The operation of the paper picking mechanism will now be explained in detail. When a paper (slip-sheet) needs to be removed in order to load the underlying plate, elevating mechanism 25 lowers picking unit 6 to its Plates Position 5. Elevating mechanism 25 may comprise a timing belt, or may alternatively comprise a pneumatic or electric motor. At the Plates Position 5,

roller 20 lies on the slip-sheet 10, exerting equal pressure along the paper width. "Knee" portions 35 of spring-loaded clamps 30 also press the paper 10 in this position, causing the clamping portions 45 to assume a position distant from the roller 20.

5           Picking starts by motor 60 rotating roller 20 by means of timing-belt 50. The friction caused between the rotating roller 20 and the top slip-sheet 10 causes a fold 22 in the paper to be grabbed and elevated into the space formed between roller 20 and clamping portions 45 of clamps 30. The rotation of roller 20 stops when the fold 22 has been sufficiently inserted into the gap  
10   to be clamped, based on predefined criteria such as time or position. Next, the picking unit 6 is moved upwards by elevating mechanism 25. When knees 35 of clamps 30 are detached from the surface of the paper, the springs 40 cause movement of clamping portions 45 towards roller 20, thus clamping the paper fold 22. As the picking unit 6 moves upwards, slip-sheet 10 is drawn  
15   with it.

          The upward movement of the picking unit 6 is terminated at the Tray Position 5A. At this position the roller 20 is above the inclined tray 70. Roller 20 now starts rolling again, causing the grabbed slip-sheet 10 to advance towards the inclined tray 70 and slip along it. Once the rear edge of slip-sheet  
20   10 has been released, the paper continues in a free-fall towards a paper-collecting basket (not shown) positioned outside the CTP machine.

          It will be appreciated by any person skilled in the art that the present invention may lend itself to any process involving the need to pick any pliable sheet material, and is not limited to picking paper, or to the application of CTP.

Having described the invention with regard to certain specific embodiments thereof, it is to be understood that the description is not meant as a limitation since further modifications may now suggest themselves to those skilled in the art, and it is intended to cover such modifications as fall  
5 within the scope of the appended claims.